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JANNAF
63rd JPM / PIB / 47th CS / 35th APS / 35th EPSS / 29th PSHS
Joint Subcommittee Meeting
16 – 20 May 2016

Abstract Due Date: Monday, 7 December 2015 **Fields with an asterisk (*) are required.**

*** Title:** Evaluation of the Effect of Surface Finish on High-Cycle Fatigue for SLM-IN718

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Unclassified Abstract (250 – 300 words; do not include figures or tables)

A high-cycle fatigue (HCF) knockdown factor was estimated for Inconel 718, manufactured with the selective laser melt (SLM) process. This factor is the reduction at a common fatigue life from the maximum stress in fatigue for low-stress ground (LSG) specimens to the maximum stress of those left with the original surface condition. Various vendors provided specimens. To reduce the number of degrees-of-freedom, only one heat treat condition was evaluated. Testing temperatures included room temperature, 800F, 1000F, and 1200F. The two surface conditions were compared at constant lives, where data was available.

The recommended knockdown factor of the as-built surface condition (average roughness of approximately 245 micro-inches/inch) versus low-stress ground condition (roughness <= 4 micro-inches/inch) is approximately 1/3 or 33%. This is to say that for the as-built surface condition, a maximum stress of 2/3 of the stress for LSG can be expected to produce the same life in the as built surface condition.

As an alternative method, the surface finish was incorporated into a new parameter with the maximum stress. The new parameter was formulated to be similar to the fracture mechanics stress intensity factor, and it was named the pseudo stress intensity factor, Kp. Using Kp, the variance seemed acceptable across all sources, and the knockdown factor was estimated over the range of data identified by Kp where data occurred. A plot of the results suggests that the knockdown factor is a function of temperature, and that for low lives the knockdown is greater than the knockdown observed above about one million cycles, where it stabilizes.

One data point at room temperature was clearly different, and the sparsity of data in the higher life region reduces the value of these results. The method does appear to provide useful results, and further characterization of the method is suggested.

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- Direct questions to Shelley Cohen, by phone at 410.992.7302 x 215, or email to scohen@cadre.jhu.edu.

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